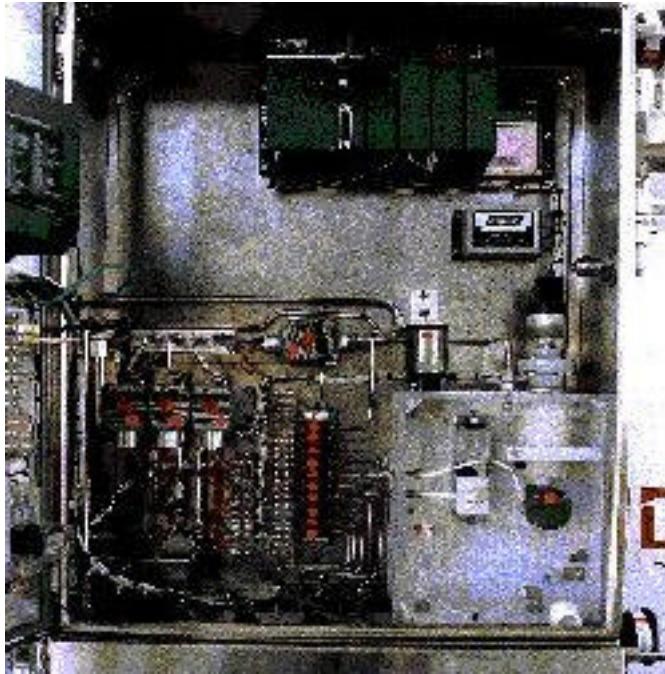


# NASA Success Story

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## Improved Nitrogen Oxide (NOx) Scrubber



NASA and I-NET Inc. (the former Engineering Support Contractor now held by Dynacs Engineering Co.), jointly developed an innovative control system and process which converts hypergolic oxidizer waste to a useful fertilizer, which can be used by KSC. It was necessary to design a control system that integrates a new hydrogen peroxide controller, pH controller, and a potassium nitrate conductivity monitor into a system that converts waste nitrogen tetroxide, the hypergolic oxidizer, into fertilizer. When fully implemented, control systems will be installed on several oxidizer scrubbers at KSC. The control system has potential for use at any location where the quantity of oxidizer requires a scrubber, including Launch Complex 40 at Cape Canaveral Air Station, Vandenberg Air Force Base in California, and White Sands Test Facility, New Mexico. Any commercial industries where oxides of nitrogen are released, such as metal finishing operations, could also use the technology.

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**NASA Involvement** Space Shuttle steering rockets use nitrogen tetroxide as their propellant, a highly toxic substance. Pipeline residuals are purged through scrubbers to capture the nitrogen tetroxide and byproducts to avoid atmospheric pollution. The scrubber liquor is a hazardous waste requiring careful disposal. In an effort to eliminate a waste stream of 250,000 gallons per year, NASA participated in the development of a control system to convert hazardous nitrogen oxide scrubber liquor to a useful, beneficial, and marketable fertilizer. No commercial controller exists that can provide hydrogen peroxide in the concentration range of 0.5 to 5.0 percent. The development

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### Point of Contact

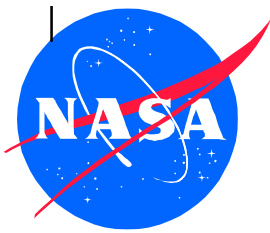
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Page 1



# NASA Success Story

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## Improved Nitrogen Oxide (NOx) Scrubber (Continued)

of the hydrogen peroxide controller was the primary technical accomplishment. It was necessary to design and build a controller that could handle the difference between hydrogen peroxide and the oxides of nitrogen. A controller was designed that used the oxidation of hydrogen peroxide with sodium hypochlorite (bleach) to produce oxygen; then the resulting pressure was measured. Since the pressure is directly proportional to the hydrogen peroxide concentration, the controller monitors pressure and adds hydrogen peroxide as required to maintain the required concentration. Other requirements were to integrate the pH controller, scrubber liquor level controller, system diagnostics, output of system status, and remote control of the system from the operations control panel.

**Social/Economic Benefit** The process eliminates KSC's second largest waste stream (and the associated waste disposal costs), replaces 10 percent of the potassium nitrate fertilizer purchased, and does not add significantly to the raw material costs. The overall cost savings is approximately \$80,000 per year. The Scrubber also provides safety and environmental improvements by reducing workers risk of exposure to toxic nitrogen oxide emissions by a factor of 10 to 200. When fully implemented, control systems will be installed on several oxidizer scrubbers at KSC.

### Industry Partner

NASA KENNEDY SPACE CENTER

### NASA Partner

Kennedy Space Center

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**Page 2**